LYMAN (C. P.)

D. H. W. Williams
with the compliments
of
W. D. Whitney.

DEPARTMENT OF AGRICULTURE.

SPECIAL REPORT—No. 31.

CONTAGIOUS PLEURO-PNEUMONIA.

THIRD REPORT

OF

CHARLES P. LYMAN, F. R. C. V. S.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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SIR: Although my recent examination of American cattle, as landed and slaughtered in England, had for its chief object the detection of the contagious pleuro-pneumonia so frequently reported by the English governmental authorities as existing among them, and the subsequent location, as nearly as possible, in the United States, of the herds from which these animals had been taken, I made my last report to you upon this subject before having had sufficient opportunity to examine as thoroughly as seemed to me desirable, the details connected with this direct investigation, because I considered that, incidentally, matters of the greatest importance connected with our cattle export trade had come to my knowledge, and that under the circumstances it was very important that these facts should come to the knowledge of Congress early in the session, so that, if they deemed them of as much importance as they seemed to me, they might have time to take such action as they deemed necessary.

Therefore the second report was made, and I was obliged to content myself, at that time, with the statement that if pleuro-pneumonia existed in the West, or if there were diseased cattle in or about the points through which the animals passed on their journey eastward, the information already possessed would, after a little further time, insure its location. That time I have now had, and in this report I intend to discuss simply the facts bearing upon these two points of the inquiry. First, by tracing back the condemned animals, so far as I have been able, from England to the States wherein they were raised, and to show what likelihood there is that contagious pleuro-pneumonia exists in any of these States. Second, by submitting to you the report of Dr. W. F. Whitney, the microscopist, whose services were engaged for the special purpose of examining the diseased portions of lung brought home by me from Liverpool; and, third, by discussing, in addition to this, which may be called the direct testimony in the case, the circumstances connected with the marketing, transporting by rail, and shipping of cattle through our uninfected districts and ports to England, *i. e.*, that part of the matter which may be called the indirect testimony, or in reality a putting together of *facts* connected with this shipping business, and drawing from them what seems to me to be reasonable deductions.

The lungs condemned in my presence were six in number, and were from animals coming from Boston to Liverpool in the following named steamers, and in the numbers given: Iberian, one; Victoria, two; Bra-

zilian, two; and from New York to Liverpool in the steamer Aleppo, one.

The history of these animals, as I have been able to learn, is as follows: Mr. Smith, butcher, bought of Mr. George Roddick, cattle salesman at Liverpool, 194 bullocks from the cargo of the steamer Brazilian, landed at Birkenhead July 7, 1880. These animals were consigned to the salesman by Messrs. J. & C. Coughlin, of London, Ontario, Canada, who bought them in Boston, to which place they had been shipped direct from the Chicago market *via.* the Grand Trunk Railway of Canada to Buffalo, thence *via.* the New York Central to Albany, thence *via.* the Boston and Albany to Boston. The lot consisted of steers from the States of *Missouri*, *Iowa*, and *Illinois.*

Mr. Alfred Dawson, butcher, bought of Mr. George Roddick, cattle salesman at Liverpool, several bullocks from the cargo of the steamer Victoria, landed at Birkenhead July 15. These animals were consigned to the salesman by Mr. Timothy Coughlin, London, Canada, who bought them in Boston, to which place they had been shipped direct from the Chicago market *via.* the Grand Trunk Railway of Canada to Buffalo, thence *via.* the New York Central to Albany, thence *via.* the Boston and Albany to Boston. This lot, as in the last case, consisted of steers from *Missouri*, *Iowa*, and *Illinois.*

Since leaving Liverpool I am advised that up to the 21st of November seven more animals were condemned, as follows: On September 5, from the cargo of the steamer Palestine, three animals. These were from a lot consigned to Messrs. Utley and Sons, of Liverpool, by Messrs. T. & F. Utley, of Boston; 44 of them were *Missouri*, and 100 *Iowa* animals. They were bought in the Chicago market and came to Boston *via.* Buffalo and Albany over the Grand Trunk, New York Central, and Fitchburg Railroads.

On November 9, from the cargo of the steamer Victoria, one animal. This was from a lot consigned to Mr. Ramsden, cattle salesman, Liverpool, by Messrs. Wales & McLeavitt, of Boston, all of them being *Illinois* steers, bought in Chicago market and shipped to Boston over the Michigan Central, Grand Trunk, Vermont Central, and Fitchburg Railroads.

On November 18, from the cargo of the steamer Bohemian, one animal. This was from a lot consigned to Mr. Hewlett, cattle salesman, Liverpool, by Mr. William Hawksworth, Brighton, Mass. They were *Illinois* steers, one-half purchased in Albany, coming to Boston *via.* Boston and Albany Railroad. They had been brought to Albany from Chicago over the Lake Shore and Michigan Southern route. The other half were bought in Brighton market, Boston, and had been brought from Chicago *via.* Grand Trunk, New York Central, and Fitchburg Railroads.

On November 18, from the cargo of the steamer Brazilian, one animal. This was from a lot consigned to Mr. William Carroll, Liverpool, by Messrs. Hathaway & Jackson, of Boston, and were all *Ohio* cattle, bought

especially for this shipment in that State, and were shipped *via.* Buffalo, and from there over the New York Central to Albany, thence over the Fitchburg Railroad to Boston.

On November 21, from the cargo of the steamer Iowa, one animal. This was from a lot consigned to Messrs. Utley & Sons, Liverpool, by Messrs. T. & F. Utley, of Boston. Fifteen or twenty of them were *Ohio* cattle, and came direct from London, Ohio, by way of Buffalo, Albany, and Fitchburg, to Boston. The remainder were *Missouri* and *Illinois* steers, and came from Chicago by Grand Trunk Road.

With one exception this traces, I believe, all the condemned animals that have arrived at Liverpool from Boston from July 7 to November 21, 1880. (The one not traced was from the cargo of the steamer Iberian, landed July 14; the reason for this will be described further on in this report.) From it will be seen that the native States of the condemned animals are Missouri, Iowa, Illinois, and Ohio; that the only markets through which they have passed are Chicago, Buffalo, Albany, and Boston; that the lines of rail that have been used are the Lake Shore and Michigan Southern, Michigan Central, Grand Trunk line of Canada, New York Central, Vermont Central, Boston and Albany, and the Fitchburg, or, as it is sometimes called, the Hoosac Tunnel route.

Cattle from the United States, upon being landed in Liverpool or at Birkenhead, are driven into stables erected for the purpose upon the wharves upon which they are landed, and are tied up in rows facing each other between which there is a passage way. After they have remained here, resting and feeding for at least twelve hours, they are examined by the veterinary inspector of the port, and, after they have passed this examination the salesman to whom they are consigned is at liberty to sell them, and the butcher who buys them, to drive them into the shambles, also situated upon the same wharf, where they are killed under the restriction that all *lungs* must be laid aside until they have been examined by the inspector, when those not condemned may be disposed of in any way that the owner sees fit. This examination is made by clasping, one at a time, the lungs between both hands, and in this position passing them over their entire surface, when, if anything peculiar is *felt*, it is cut down upon and examined. In this way the slightest variation from the normal becomes at once apparent; in fact, it is surprising how quickly the smallest change in them may be located. In this connection I also wish to have the fact borne in mind that in no one of these cases condemned in my presence did the inspector discover the disease before the animal was killed, although every animal was closely inspected in the way described, and in no one case was there any appearance about any one of these condemned animals that caused the slightest question to be raised as to his healthfulness, notwithstanding he had but very recently passed the scrutiny both of the port inspector and the butcher who had bought him; nor was there one of them that was not fully up to the average of his fellows in flesh.

The microscopic appearances of these six lungs in their fresh state were as follows:

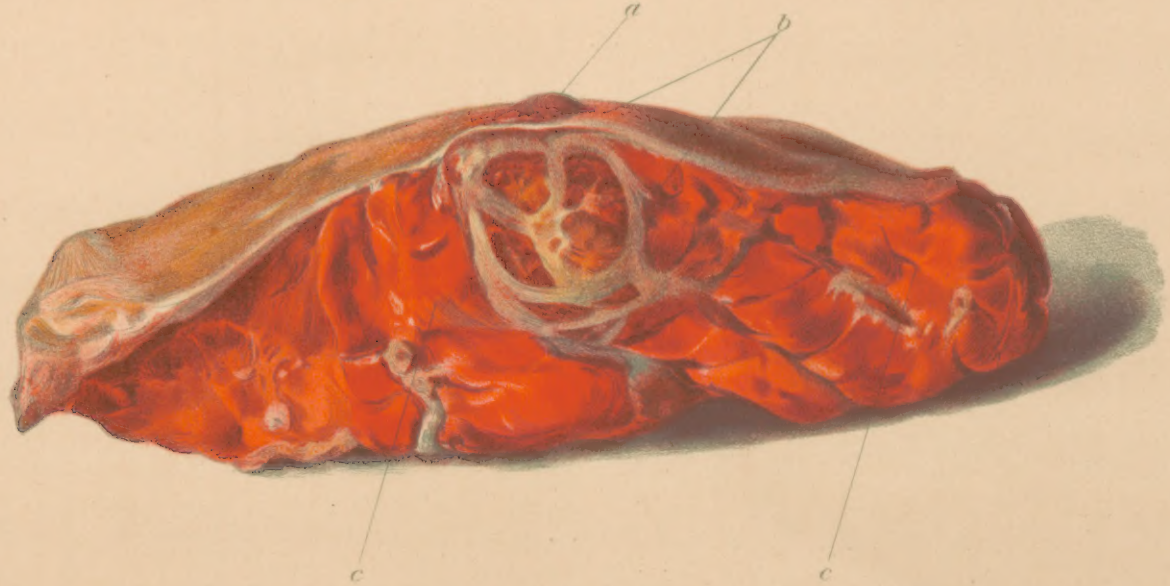
Brazilian No. 1.—This lung contained, in about its center, a large, hardened object that could be both seen and felt, and would measure, perhaps, about six inches through its largest diameter. This, upon being cut into, appeared to be an abscess containing nothing but a pure, rather thick, creamy pus, and, although any portion of dead tissue that might be contained within this cavity was thoroughly searched for, nothing of the sort could be found. The cavity was surrounded by what seemed to be a rather thick cartilaginous wall, this again by a considerable amount of "marbled" tissue in which the parenchymæ was of an even pinkish color, with the interlobular thickening well marked, white, hard, and firm. This, in its turn, passed almost imperceptibly, the parenchymæ becoming gradually more and more areable, and the interlobular thickening growing narrower and narrower into the healthy lung tissue surrounding the whole.

Brazilian No. 2.—This lung, with its fellow, upon its surface presented to the eye no indication of disease, but upon being handled in the way described above, several small nodules within its substance at once became apparent; these, upon being cut down upon, in the one lung disclosed the unmistakable lesions of tuberculosis, and in the other, where these indurations felt were much fewer and smaller, the nodules showed the peculiar lesions upon which it was condemned. There were several small nodules situated in the periphery of the extreme posterior portion of the large lobe of the right lung, the larger of which was about one-half inch in diameter; in its center there appeared to be a cheesy deposit; this was surrounded by a very thin layer of a thin grayish-colored pus; outside this a very thin membrane; outside this again, a very limited amount of marbled tissue which, near the center, was well marked, but more indistinct toward its outer margin. Of these nodules there were some four or five perfectly isolated from one another, but all being, to the unaided eye, of the same description.

Victoria lungs.—There were two pairs of these, condemned from the same lot at the same examination. One lung showed one and the other three indurated spots upon which the lungs were condemned. The largest of these "spots" was about the size of an English walnut, and was situated exactly at the root of the lung; the remaining three were situated in various isolated positions in the substance of the lung. Upon being cut down upon they all exhibited the same general appearance as those of the Brazilian No. 2 lung already described, except that in the case of the largest specimen there was a fair amount of sub-plural thickening, although there had been no adhesion between these surfaces. Of this portion of lung Dr. Whitney says: "The size and appearance of the diseased portion after a clean cut had been made through it is represented on Plate IV. The disease involves about one-half dozen lobules, representing about 50 to 75 cubic centimeters in bulk (Plate IV

Plate VII.

Contagious Pleuro-Pneumonia of Cattle.



Portion (natural size) of condemned lung from American Bullock, slaughtered in Liverpool, England.

A. Hoen & Co. Lithocaustic, Baltimore.

a). These are quite homogeneous in appearance, and within them are seen one or two small irregularly rounded cavities containing a cheesy material. The interlobular tissue between them and the more healthy portion of the lung (Plate IV int. tis.) is very thick and dense." In its fresh state this cheesy deposit was surrounded by a thin layer of what appeared to be a thin, grayish pus; this again by a thin membraneous wall, this by the "marbled" tissue, limited in extent, and surrounded on three sides by healthy tissue.

Aleppo lung.—The lung from which this specimen was taken was from a bullock, killed in Liverpool, July 23, and which the inspector said he considered a fine specimen of contagious pleuro-pneumonia, and, as will be seen by reference to Plate VII, which is copied from a painting made by a leading firm of photographers in Liverpool from the lung itself, on the same day upon which it was taken from the animal, and is a most perfect representation of its appearance, has very much the look of that disease; indeed so close is its resemblance that no one would be warranted in saying that it was not it until a most thorough examination had been made of the specimen.

Plate VII *a* represents the point at which adhesion had taken place between the two pleural surfaces, and at which, upon being broken down by the fingers, there was left a small rounded eminence of loosely formed connective tissue *b*, the diseased nodule showing the discolored lobules and the greatly thickened interlobular tissue; *c*, *c*, healthy lung tissue.

After getting this portion of lung to Boston, another cut was made into the nodule parallel to the first, and at a point directly through the center at *a*. The surface thus exposed had a very different appearance. At about the center of the nodule was a small, irregularly shaped cavity surrounded by a mass of material having a grayish cheesy look; in fact giving precisely the appearance noticed in all of the specimens except the Brazilian No. 1.

Iberian.—This specimen was not retained by me, nor were any inquiries made about it that would enable me afterwards to trace the animal in the United States, because at the time it was discovered by Mr. Moore, the inspector, and shown to me, I did not think that there was the slightest indication of pleuro-pneumonia about it, and so told Mr. Moore, who, I thought, agreed with me at the time, and so the lung was not retained. Two days afterwards, however, I found, much to my surprise, that it had been condemned and reported to the London authorities as having been a case of pleuro-pneumonia. My recollection of its appearance is that it contained seven or eight nodules isolated from one another, consisting of a small cheesy deposit no larger than a pea, surrounded by a thin membrane, and showed *no* marbled tissue whatever.

In addition to this description I may say that every specimen described in this report was seen and examined by Inspector Professor Duguid, of the London office, and pronounced by him to be undoubtedly

pleuro-pneumonia. Also that each and every one of them were shown in August last to Professor Williams, who declared that, in his opinion, none of them were pleuro-pneumonia unless it was the Aleppo specimen, upon which he would give no opinion without a chance for a more minute examination of it.

MICROSCOPIC EXAMINATION.

All of the specimens of lungs which I have endeavored to describe were given by me to Dr. W. F. Whitney, of Boston, Mass., curator of the Warren Anatomical Museum, and assistant in pathological anatomy in the medical department of Harvard University, who made a most thorough microscopical examination of them, and whose report upon the subject I have the honor to herewith submit:

BOSTON, MASS., *December* 30, 1880.

CHAS. P. LYMAN, F. R. C. V. S.,
Veterinary Surgeon Department of Agriculture:

DEAR SIR: At your request I have examined the portions of lungs coming from American cattle killed in Liverpool, said to be affected with contagious pleuro-pneumonia.

From a careful study of those specimens in comparison with others obtained from an unquestionable case of that disease, and from the description of its characteristics as given by Williams, Yeo, Roy, and others, it appears that the changes seen in those specimens are caused by *chronic inflammatory processes, especially of the interstitial tissue, in some cases combined with miliary tuberculosis, which, reasoning from analogous processes found in the human lung, are not contagious.*

In proof of the above statement I send you herewith the preparations upon which it is based, with drawings, and in explanation of them will call your attention, first, to the relations of the healthy lung, then to the changes seen in a lung affected with contagious pleuro-pneumonia, and, finally, to the manner in which the changes seen in the specimens sent for examination differ from those of that disease.

The lungs of cattle differ from those of man, in that each lobe is distinctly subdivided into numerous lobules (each occupying the space of from 10 to 30 cubic centimeters) joined to each other by fine bands of connective tissue, which also forms the walls of extensive lymph spaces, connecting on the one hand with those lying in the pleura, and on the other with the lymph canals, which nearly surround the blood-vessels accompanying the bronchus into the lung tissue. These relations are shown in the preparation marked "normal lung of bullock, lymph spaces injected with blue," and from which Plate I has been drawn. Fig. 1 represents a section through the whole of one and part of an adjoining lobule with the uniting bands of connective tissue inclosing lymph spaces. The extreme thinness of this band is especially to be noticed. The walls of the alveoli, which form the lung tissue proper (Fig. 1, lung tis.), are fine, and have a slightly wavy crinkled outline, and in them are a few scattered lymph and epithelioid cells. One or more small bronchi are usually to be found in each lobule. A more highly magnified view of one of these is represented in Fig. 2. In this can be distinguished three coats, a mucous or inner coat, a muscular or middle coat, and an external coat. The mucous coat (Fig. 2, muc. ct.) is formed by a layer of columnar epithelium, its inner surface resting upon a narrow zone of con-

Contagious Pleuro-Pneumonia

A Hoen & Co. Lithocaustic Baltimore

Contagious Pleuro-Pneumonia

A. Hoen & Co. Lithocaustic, Baltimore

nective tissue (submucous coat) which is thrown into folds when the bronchus is contracted. The muscular coat (Fig. 2, mus. ct.) is composed of unstripped fibers arranged concentrically. Outside of this is the external coat, composed, for the greater part, of a collection of round cells, probably of a lymphoid character, separating it from the accompanying artery and vein (Fig. 2, art. and v.), which are almost surrounded (in some places entirely so) by the lymph canals (Fig. 2, lym. sp. c.).

In the diseased lungs the changes occurring in the connective tissue, including the lymph spaces, in the alveoli with their walls, and in the bronchi, will be considered and compared with each other.

CONTAGIOUS PLEURO-PNEUMONIA.

Contagious pleuro-pneumonia presents three stages (designated as A, B, and C), dependent upon the degree to which these tissues are affected.

In the earliest or stage A (see preparation marked contagious pleuro-pneumonia, stage A, from which Plate II has been drawn) the most marked changes are in the lymph spaces. Those in the pleura are in a great measure obliterated by the growing together of its two layers, and such as remain (Plate II, lym. sp. A) are filled with young round cells, leaving only a narrow passage close to the wall. The interlobular spaces (Plate II, lym. sp. B) are filled with a semi-gelatinous fluid, which in hardened specimens becomes coarsely fibrilated and in which are a few scattered round (lymphoid) cells. The bands of connective tissue forming the walls of the lymph spaces are but slightly thickened. In the lymph canals about the vessels are a few clumps of lymph cells. The opening of the canal is in general free (Plate II, Figs. 1 and 2 lym. sp. c.).

The walls of the alveoli have no longer a crinkly outline but a slightly stiff appearance, giving the alveoli a much rounder look. This is partly due to an engorgement of the vessels and partly to an increase of lymph and epithelioid cells in and upon the walls (Plate II, Fig. 1, lung. tis.).

In the small bronchi the changes are confined to the mucous coat (Plate II, muc. ct.), which is thickened from a proliferation of the epithelium, the cells next the free surface having a tendency to degeneration as shown by a slight detritus.

In the second stage (see preparation contagious pleuro-pneumonia, stage B) the exudation in the interlobular lymph spaces is firmer and there are a greater number of cells. The walls of the spaces are but little changed from the preceding stage. The canals about the vessels are more extensively filled with cells, and here and there a vessel is plugged.

Most of the alveoli are filled with an exudation, in places resembling that in the interlobular lymph spaces in stage A, and similar to that found in croupous pneumonia of the human lung, in places consisting entirely of lymph and epithelioid cells. The contents of certain of the alveoli take coloring matter badly, showing that a degeneration has taken place in the cells.

The mucous membrane of the bronchus is much thickened, and in the opening of the tube is to be seen detritus of exfoliated and degenerated epithelium.

In the third stage (see preparation marked contagious pleuro-pneumonia, stage C, and from which Plate II has been drawn) the interlobular exudation is a little firmer and more fibrillated, the original walls of the lymph spaces are still to be distinguished as moderately thick-

ened bands (see Plate III, Fig. 1, lym. sp. B). The canals about the vessels (Fig. 1, lym. sp. C) are completely filled with lymphoid cell, the vessels are usually plugged, and a more or less extensive hemorrhage may take place into the surrounding tissue (see Fig. 1, art).

The alveoli are filled with lymph and epithelioid cells, in many cases degenerated and retracted from the walls into little granular clumps. The walls themselves are much thickened in some places from an hypertrophy of the fibers of unstripped muscular tissue, which is normally present in small amount, especially at the place where the bronchus passes into the alveoli (see Fig. 2, mus. hyp.)

The bronchi in this stage are only distinguished with difficulty, and the explanation lies in the fact that the mucous membrane has become entirely degenerated and cast off from the walls (see Fig. 1, br. muc. ct.), the cells reduced to a detritus which, together with lymph and blood cells, completely occlude the opening, leaving no characteristics by which to distinguish it from any other plugged vessel.

Upon grouping together the appearances as presented in the different stages, it is manifest that the lymph spaces are at first filled with a coagulable material, and the increased density of this in the later stages of the disease are due to an increase in the number of cell elements and not to a material increase in the thickness of the walls of the spaces. With the increasing firmness of this exudation the alveoli are filled with cells and exuded material, as are also the lymph canals about the vessels; and when this has reached a marked degree, the mucous coat of the bronchus, which in the earlier stages of the disease has taken part by a proliferation of its epithelium, is cast off and the tube is filled with its detritus and an exudation similar to that in the neighboring lymph canals. The muscular coat of the bronchus resists longer and can be clearly distinguished after the mucous coat is destroyed. With this filling of the lymph canals the vessels are occluded and hemorrhage may take place into the surrounding tissue.

DISEASED LUNGS FROM LIVERPOOL.

The one first examined was marked "Steamer Victoria, from Boston, July 19, 1880, Liverpool," and will be referred to as the Victoria lung.

The size and appearance of the diseased portion after a clean cut had been made through it, is represented in Plate IV. The disease involves about one-half a dozen lobules, representing about 50–75 C. C. in bulk (Plate IV, A). These are quite homogeneous in appearance, and within them are seen one or two small, irregularly rounded cavities, containing a cheesy material. The interlobular tissue between them and the more healthy portion of the lung (Plate IV, B) is very thick and dense (Plate IV, int. tis.).

The whole has a resemblance to contagious pleuro-pneumonia in that the lobules and interlobular tissue are involved, but differs in the small amount of tissue implicated when considered in relation to the *degree to which* the interlobular tissue is affected. What the cause of these changes is, will be understood from the preparation marked S. S. Victoria, &c., and from which Plate V has been made.

Looking first at the interlobular spaces it will be seen that there is no longer any trace of the lymph spaces, but that the lobes are joined by a firm band of connective tissue, rich in young cells. (Plate V int. tis.) The earlier stages of this are seen in that part of the preparation which shows no changes to the unaided eye (this is not shown in the drawing), and there it appears that this tissue results from a thickening of the

Plate III.

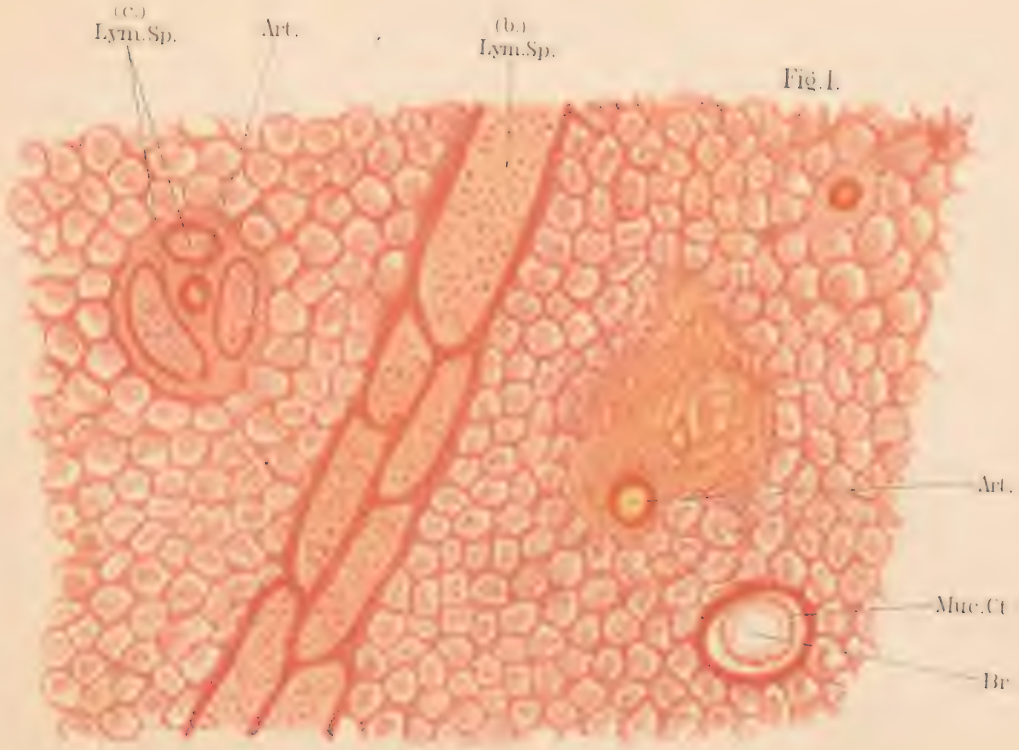


Fig. 1.

Fig. 2.

CONTAGIOUS PLEURO-PNEUMONIA

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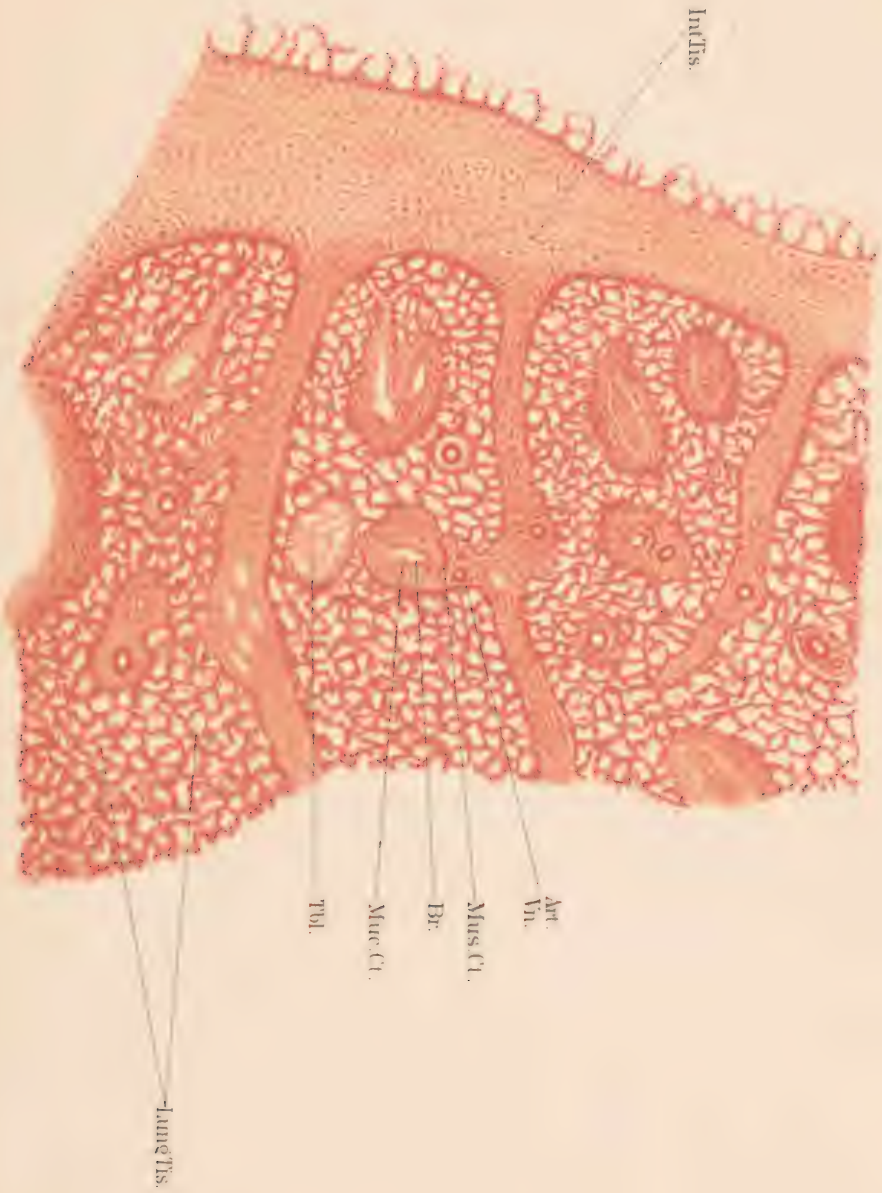
Contagious Pleuro-Pneumonia.



Contagious Pleuro-Pneumonia

A. Hoen & Co. Lithocaustic Baltimore

Contagious Pleuro-Pneumonia

A.Hoen & Co Lithocaustic Baltimore

walls of the lymph spaces. Later, when this has become dense, an accumulation of cells takes place in the contracted spaces and the whole becomes fused into the firm mass shown in the drawing.

From the action of this connective tissue the alveoli are compressed and the walls are slightly thickened from the presence in them of large numbers of young cells. There is but little tendency, however, to exudation or accumulation of cells within the alveoli.

The greatest changes within the lobules are seen about the bronchi and their accompanying vessels. It will be remembered that there is normally a narrow zone of connective tissue, rich in cells surrounding the bronchus and separating it from the adjacent vessels. These cells have proliferated to such an extent as to form a wide band about the bronchus, involving the blood-vessels, which are, however, still pervious, but compressing the lymph canals to such an extent that their presence is with difficulty made out. The coats of the bronchi are also affected, but in the reverse order from what they are in contagious pleuro-pneumonia, viz: The muscular coat has almost disappeared (see Plate V, mus. ct.), while the mucous coat (see Pate V, muc. ct.) remains quite distinct, and the opening of the bronchus (contrary to the case in pleuro-pneumonia, when the cellular exudation is as extensive as here) is patent and even slightly dilated (condition known as bronchiectasis). This proliferation about the bronchi (known under the name of peribronchitis) may become degenerated finally and thus give rise to the small cavities filled with cheesy detritus noted in the description of the specimen (Plate IV, A).

The commencement of such a degeneration may account for the appearance seen in the middle lobule of the preparation (see also Plate V, tbl.), or it may be due to a secondary tuberculosis.

The whole process can be classified as one of chronic interstitial pneumonia, with peribronchitis and bronchiectasis with the formation of cavities.

STEAMSHIP BRAZILIAN, FROM BOSTON.

The next two specimens examined were both marked S. S. Brazilian, from Boston, and will be described as Brazilian lung No. 1 and No. 2.

Brazilian lung No. 1 consisted of several pieces forming part of the wall of a large abscess. The side of the specimen which lay next to the cavity of the abscess was quite smooth, and the tissue immediately adjoining was firm, dense, and quite homogeneous, so that the outline of the lobules could only be made out with difficulty. This very dense portion extended for about 1–2^{cm}, when the tissue began to assume more the appearance of normal lung; only that between the lobules were firm bands connecting directly with the dense tissue near the edge.

Two preparations were made from this, one from the dense portion and the other from the more healthy looking part.

Upon examining the former (see preparation marked S. S. Brazilian No. 1, near abscess wall, and from which Plate VI has been drawn) it will be seen that the great increase in density is principally due to an increased thickening of the interlobular tissue (see Plate VI, int. tis.), and upon comparing this with the preparation made from the more healthy portion (see preparation marked S. S. Brazilian, recent disease) it will be found that this increase is due, as in the case of the Victoria lung, to a thickening of the walls of the lymph spaces rather than to an organization of a material filling the lymph spaces.

In the thick bands of connective tissue traces of small vessels are seen, showing that the process has been of long duration. The bronchi

lying in their midst are still open and to be distinguished by their epithelial lining, but their muscular coat has almost disappeared.

In the recent preparation the alveoli show simply the results of compression, with an increase of round cells in their walls. Near the abscess wall the lobule is quite solidified, but this is due not to an exudation into the alveoli, but to the effects of the compression of the connective tissue and to a thickening of the walls by a round cell infiltration. Scattered throughout the alveoli lobules, replacing one or two alveoli, in the walls of the smaller bronchi and in the bands of new formed connective tissue are small circular collections of round cells, having a tendency to degeneration with a sharp line between them and the surrounding tissue (see Plate VI, tbl.): these are probably minute points of chronic purulent inflammation, but may belong to the class of tubercles, although only about half the size of those bodies and lacking in giant cells and stroma.

The changes found in this lung are those of chronic induration, which are entirely explained by the proximity to the large suppurating cavity, and have nothing in them indicative of what may have been the cause of it.

Brazilian lung No. 2.—In the second specimen from the Brazilian there were two nodules from different parts of the lung, showing different stages of disease, the one more advanced than the other.

In both of these nodules there were only a few lobules which presented any changes from the normal, and in the more recent specimen it was only in a single lobule that these changes reached a marked degree.

In this the lobule, which was the center of the disease, was quite homogeneous, except in the middle, where a portion of the tissue was separated from the rest by a distinct line of irregularly indented outline. In this portion were numerous small losses of substance, giving to the whole a slightly necrosed look. This central lobule was separated from the adjoining ones by a firm, broad band of tissue, while in the more remote interlobular spaces the walls of the lymph spaces were seen to be thickened and lying in the spaces thus reduced in diameter by this thickening of the walls, were firm, fibrous-looking masses, which were only slightly adherent to the walls, and could in consequence be withdrawn intact. In contagious pleuro-pneumonia, it will be remembered, the substance filling the interlobular spaces is perfectly continuous from side to side, and cannot thus be withdrawn.

From this specimen three preparations were made, two from the recent nodule and one from the more advanced.

The first of these (see preparation marked S. S. Brazilian No. 2 (A), recent disease) was taken from the recent nodule in the tissue from the neighborhood of the central diseased lobule, and presented to the eye only a thickening of the interlobular tissue with masses in the lymph spaces. Under the microscope it was found that the walls of the lymph spaces were thickened in the same way as in the previous cases, and that the masses lying in the spaces were composed entirely of cells, having none of that peculiar loose, meshed, fibrillated network characteristic of contagious pleuro-pneumonia. About the small bronchus, with its accompanying vessels, a dense cellular infiltration is seen. The muscular coat is quite degenerated, while in one portion of the wall of the bronchus the cells have assumed an indistinctly circular outline about a centrally degenerated point (tubercle?). The changes in the alveoli with their walls are very slight, consisting only in an increase of cells.

The second preparation was made through the central lobule, in which, as described above, was a circumscribed necrosis.

The thickening between the lobules (see preparation marked S. S. Brazilian, No. 2 (B), recent disease) is due, as in the previous cases, to a thickening of the walls of the lymph spaces, with here and there narrowed lymph spaces filled with cells more or less adherent to the walls. In the preparation colored by hæmatoxylon the necrosed portion is brought sharply out by a deep blue line, lying just within its border, and due to the presence of a large number of cells and nuclei. Within this line the alveoli are filled with yellow, finely granular detritus, in which lie scattered nuclei and cells in the process of degeneration. Very few nuclei or cells are seen in the alveolar walls, and the whole looks dead. Within the center of this necrosed portion are seen the blood vessels still pervious, surrounding which is a zone of cell infiltration as shown by the deep color. The bronchus lies between the vessels, but can only be distinguished with difficulty, since the external and middle coats are almost obliterated, the mucous coat destroyed, only one or two projections of the submucous coat remaining to mark its character, and the opening of the tube filled with round cells and nuclei.

The walls of the alveoli of the tissue bordering this necrosed portion are very much compressed, and, together with the new cells, which have been inflated, form a sort of wall. The remaining alveoli are comparatively free, although a few are filled with the same yellow finely granular detritus as are those within the necrosed portion.

Within the nodule or more advanced disease was a cavity ½ to 1 centimeter in diameter, surrounded by a thick wall, and the lobule containing it was separated from its neighbors by thick bands of tissue, which could be followed for some distance among the more healthy lobules.

Under the microscope (see preparation marked S. S. Brazilian, No. 2, advanced disease) it appears that the interlobular tissue is composed of the same connective tissue, only rather firmer than marks the preparations already examined, and has apparently been formed in the same way. The wall about the cavity is also composed of a similar fibrous tissue rich in cells, and passes insensibly into the walls of the alveoli which are compressed and slightly thickened, but otherwise comparatively open. Surrounding the bronchi and vessels are an accumulation of cells which have infiltrated the bronchus from without inwards, leaving still a remnant of the epitheleal lining.

The general outline of the cavity is such as to indicate that it had been formed by a necrosis of a circumscribed portion of the lung, as in the more recent specimen. This necrosed portion has been gotten rid of, and the slight wall of separation seen in the recent specimen has been thickened and condensed.

The whole process is one of chronic interstitial pneumonia with peribronchitis and necrosis of the lung tissue.

STEAMSHIP ALEPPO, FROM NEW YORK.

The specimen was a portion of lung about half the size of the palm of the hand, in which was a firm wedge-shaped nodule, the base of which measured 2×2.5^{cm}, and was at right angles to the pleural surface, which was slightly thickened all over the portion of lung. The nodule was quite homogeneous in appearance, with broad bands of tissue separating the lobules. In one of the lobules there were small losses of

substance, giving to that part a honeycombed look, and in another lobule there was a small cavity.

The bands of interlobular tissue (see preparations marked S. S. Aleppo from New York, from diseased nodule, and S. S. Aleppo, &c., section of entire nodule) are composed, as in the previous cases, of firm connective tissue quite well vascularized, showing here and there the presence of masses of cells in the narrowed lymph spaces.

The lung tissue is compressed and the alveolar walls are thickly studded with round cells and nuclei. In the honeycombed tissue mentioned above (see preparation marked from diseased nodule) these cells are collected together in little round groups, which were often degenerated in the centers, causing the little losses of substance referred to. The alveoli themselves were filled with exuded masses, detritus, and cells.

The section through the lobule containing the cavity (see preparation marked section of entire nodule) shows that the cavity is surrounded by a thick wall having a slightly reticulated appearance and here and there giving the outline of a circular body. In the remaining parenchyma of the lung are two or three round bodies of a similar size with a rather broad meshed stroma, in which lie round cells (miliary tubercles).

The bronchi and vessels are surrounded by accumulated cells.

Many of the alveoli of the lobules bordering upon the diseased nodule are filled with blood corpuscles, which, however, lie freely within them, and have not uniformly infiltrated all the tissue as is the case in the hemorrhagic infarction of the contagious pleuro-pneumonia.

The whole process can be classified as one of chronic interstitial pneumonia, combined with tuberculosis and the formation of cavities.

CONCLUSION.

Looking at the cases as a whole, it will be seen that they are the results of inflammations of different parts of the constituents of the lungs, there also being indications in all the specimens that tuberculosis may take part in producing some of the changes.

The antecedence of one process over the other cannot be exactly determined, but judging from the thickness of the interlobular connective tissue, and the fact that it can be distinctly traced among the apparently unaffected lobules, it is probably implicated among the first, and from the fact of the thickness of this tissue as compared with the small amount of lung involved, the processes must be placed among the chronic ones, which require weeks or months rather than days for their accomplishment, and as such are probably not contagious.

Yours, truly,

W. T. WHITNEY.

Therefore, if we may place *any* value upon facts as evidenced by the microscope—and who will say that we cannot?—the absolute fact is well shown that not only were the lungs condemned in my presence as being affected with pleuro pneumonia *contagiosa* not affected with that disease, but that the changes noticed in them, in all but one case, were due to a chronic interstitial pneumonia with peribronchitis, with necrosis and the formation of small cavities at and within the lung tissue proper; and further, there are evidences amounting to a certainty, in

one case at least, that the disease known as tuberculosis, probably, plays a more or less prominent part in the etiology of these changes. The other lung (Brazilian No. 1) that cannot be included in this class of cases, was, however, very distinctive, in that the lung contained the large abscess, already described, and the microscope shows the changes in the lung tissues, upon which the condemnation was made, to have been chronic induration of these tissues, caused by the pressure upon them of the large abscess found to exist in their immediate neighborhood; in fact just the condition that under the circumstances we would expect to find. I think that, without pursuing the history of the beasts from which these lungs came, it may be safely stated that they were not affected with contagious pleuro-pneumonia. The next thing, therefore, will be to consider these cases that have been reported as being diseased with contagious pleuro-pneumonia since the time I left Liverpool, and up to the 21st of November last, of which there were seven, as has been already stated. As the lungs, or diseased portions of them, were not obtainable for examination, it will be possible only to show by negative evidence what the probabilities are respecting them. As you will remember they came to Liverpool by various steamships from Boston: to Boston they came from Missouri, Iowa, Illinois, and Ohio, and none of them were at any time in any of the cattle markets except those of Chicago, Buffalo, Albany, and Boston; and the only lines of rail over which any of these passed were the Grand Trunk of Canada, New York Central, Fitchburg, Michigan Central, Vermont Central, Boston and Albany, Lake Shore and Michigan Southern.

It will be shown further on that there cannot be any disease in Chicago or Buffalo, and the same argument will be as true regarding Albany as Buffalo. In the case of Boston I may say that ever since the "stamping out" of pleuro pneumonia from Massachusetts in 1867 there has always existed, and does to-day, in this State a most efficient board of State cattle commissioners, composed, amongst others, of the same veterinarian (Dr. E. F. Thayer) under whose administration the disease was "stamped out," and that although this board has, during all these years, kept a most lively lookout for any cases of the disease within their State, and although thousands of animals have been examined in Brighton market, alive and dead, by Dr. Thayer, not one single case of pleuro-pneumonia has been discovered within that State within the last 14 years.

Regarding the native States of these cattle, it may be said that in Missouri this department has 104, in Iowa 84, in Illinois 86, in Ohio 83 correspondents, whose particular duty it is to inform themselves as to the nature of any disease that may at any time show itself among the animals within their district, and that these correspondents have not at any time reported the existence of any disease the symptoms of which at all similated those of contagious pleuro-pneumonia, although every

special effort possible has been made to discover it, should it exist there. So far as is known, and equally strenuous efforts have been made to discover the facts, pleuro-pneumonia does not exist in any region of country through which the lines of rail over which these animals have been carried passes. This, then, leaves as the only possible source of contamination the cars in which the animals have been conveyed. That the disease may have been contracted in this way is possible, but not at all probable, and as bearing upon this point it may be said that cattle going to Boston for local uses are conveyed in exactly the same way, and often times in the same cars, as the animals going from thence to Great Britain; and that, although I myself have examined many hundreds of these, alive and dead, I have never yet found a single case of contagious pleuro-pneumonia; and this is the fact, as I have before stated, regarding the very extensive examinations made of these same animals by the Massachusetts State board of cattle commissioners.

In considering this question in all its phases, I am naturally led to a review of the circumstances attending the landing and examination of the cargo of animals *ex* steamship Ontario, which arrived at the port of Liverpool on the 26th of January, 1879, consisting of 195 cattle and 2 carcasses: 87 head of cattle had been thrown overboard on the voyage, thus making the original shipment 284. These animals were shipped from Portland, Me., but of their origin Mr. Welsh, Minister of the United States at London, says: "From reliable parties in Liverpool I learn that while a part of the cattle by the Ontario came from Chicago, and a part from Buffalo, at least 45 head of them came from Toronto, and were so mixed with the others that the Canadian and United States cattle could not be distinguished. It is also beyond dispute that those which came from the United States passed for several hundred miles over the Grand Trunk Road through the Dominion of Canada; that all the cattle were exposed to weather of unusual severity; that they remained for a considerable time in Portland without food or water, and that they had undergone an exceptional amount of hardship and bad usage before entering upon a voyage which was made at an inclement season and during excessively rough weather." In a memorandum on the subject, Professor Brown, of the Veterinary Department of the Privy Council, says: "On examining one of the carcasses, the inspector at Liverpool found evidence of pleuro-pneumonia, and forwarded portions of the lung to the Veterinary Department. This specimen was found to represent the characteristic indications of the contagious pleuro-pneumonia of cattle so well known in this country. By direction of the Lord President, I immediately instructed Mr. Duguid, one of the inspectors of this department, to proceed to Liverpool and report as to the condition of the animals which had been detained there. Mr. Duguid remained at Liverpool and superintended the slaughter of the cattle, and in the course of the *post-mortem* examination he detected thirteen cases of pleuro-pneumonia *in*

various stages." Now take the statement of Professor Walley, made to me in Edinburgh, in July, 1880, in regard to this matter. He says:

"I was called to Liverpool and there shown animals together in a building which, I was told, came per steamship Ontario from America; a few of them were coughing, I should judge giving the pathognomonic cough of contagious pleuro-pneumonia. *I examined them: they gave no elevation of temperature that amounted to anything as a sign;* they varied a little: some would be a degree higher than others, but nothing remarkable in any. While this examination was going on, *and before we had finished to my entire satisfaction*, a man came to say that we were wanted in the slaughter house, where we went at once, and found two animals that we were told had been taken haphazard from this cargo of the Ontario, hanging partially dressed, and from these I saw lungs taken that exhibited to me, without any doubt, the well known lesions of contagious pleuro-pneumonia. I was not at the place for more than an hour."

In answer to questions, he further said:

"The animals were in as good condition as any of the others: that there were several diseased spots in their lungs; that the diseased portions were 'marbled,' and the parenchyma varied in color from deep red to pink, but it was mostly of a pinkish shade; that there was no attempt towards the formation of a cyst wall around any of the diseased portions, because the disease had not been of sufficient standing."

I have made these extracts because they seem to me to embrace the entire evidence tending to show that the disease on the Ontario was contagious pleuro-pneumonia; and I think it worth while to put in contrast with them here what may be called the circumstantial evidence tending to show that there may have been some mistake.

The fact seems to be beyond dispute that so far as the animals came from the United States they came from Chicago and Buffalo *via* Canadian Grand Trunk Road to Portland. Since 1877 the Department of Agriculture has had, all through the West, regular correspondents, whose duty it is to collect and forward evidence relating to any disease, contagious or otherwise, that may prevail to any extent in the different localities in which they are located. In this way nearly every disease that animal flesh is heir to has received some sort of mention, but in no case has any description been received that could in any way be construed into a description of contagious pleuro-pneumonia of cattle. Besides this, the department kept Veterinary Surgeon H. J. Detmers at the Chicago live-stock yards, examining cattle with the single view of ascertaining whether any trace of this disease could be discovered in that great depot for western cattle. This examination, which was made in 1879 and continued for some time, showed that it was unknown there. The market of Buffalo is in the State of New York, and therefore came directly under the examination of Prof. James Law, Veterinarian-in-Chief to the State of New York, whose particular business, under a special law, was to find and get rid of, so far as any means at his command would allow of its being done, this very disease—pleuro-pneumonia of cattle—and with the splendid system of detecting its existence in any

cattle within the State, and with the great facility which he had for tracing any diseased animals that were found to their starting point, he was never able, in any way, to locate the disease in Buffalo or at any point in the State within 400 miles, or thereabout, of that market Neither has this department, although every means at its command has been tried, ever been able to find that it had any existence at any time nearer to Buffalo than the points indicated by Professor Law. Now we have in evidence that these animals passed for several hundred miles over the Grand Trunk Road. To do this and get to Portland after leaving Buffalo, they would not again enter the States until they had reached Vermont, where they cross a small portion of the extreme northeasterly corner of the State; thence across the extreme northerly portion of New Hampshire; thence for a short distance across the southerly portion of Maine to Portland; and at no time would they be nearer than Portland to the infected district, the nearest point of which is something over 300 miles away. It may be stated to a certainty that contagious pleuro-pneumonia of cattle does not exist in either Vermont, New Hampshire, or Maine. How, then could these animals have become infected? So far as the territory through which they traveled on their way to the seaport lies within the United States, it can safely be said that no pleuro-pneumonia exists along, or anywhere near, their line of route. The cars in which they traveled could scarcely have been previously contaminated, for presumably they were those of this great northern trunk line, and would never be sent down into the neighborhood of New York, Philadelphia, or Baltimore for the conveyance of local cattle freight. The only way, then, would seem to be that the disease was contracted on board ship during the voyage. But ships that have carried cattle are, on their return to Liverpool, required by law to be *thoroughly disinfected*, so that unless the Ontario, on her out voyage, brought to this country from England cattle affected with contagious pleuro-pneumonia, she could scarcely convey it to other and hearty beasts on the return trip.

That pleuro-pneumonia did exist among these cattle we have the evidence of, first, Mr. Moore, the inspector, who discovered it; second, that of Professor Duguid, who was sent down from London for the express purpose of inspecting this cargo; third, that of Professor Walley, who came from Edinburgh for the same purpose, all of them gentlemen who are particularly well qualified to judge of the matter, and give a valuable opinion regarding it. But it certainly does seem that Professor Duguid and Mr. Moore were undoubtedly mistaken as to the lungs condemned by them in my presence last July and August. May it not be that pleuro-pneumonia *contagiosa* is, after all, not so distinctive in its appearance as has always been supposed, or rather that changes are produced by certain other diseases, the lesions of which resemble so closely those of contagious pleuro-pneumonia that in the absence of any history of the animal would require a much more careful examination to detect its difference than veterinarians have heretofore supposed to be necessary?

The other gentleman, Professor Walley, says that he should judge that these animals were giving the pathognomonic cough of pleuro-pneumonia, but that he examined them, and even with the thermometer (a most delicate aid in these cases) he could get no indication that amounted to a sign that they were diseased; but still, *before he had finished his examination to his entire satisfaction*, he was called away to the slaughter-house, where he saw lungs removed from two beasts that to him presented "without any doubt the well-known lesions of pleuro-pneumonia." These lungs were marbled, and the parenchyma varied in color from deep red to pink, but it was mostly of a pinkish shade; that the largest diseased spot was as large as the crown of a derby hat; that there was no attempt at the formation of a cyst wall, because the disease had not been of sufficient standing; that the animals were in as good condition as any of the others, and that they had been selected haphazard from among the cargo in question. Is it not remarkable that although so large a portion of lung was affected there was no sign or symptom by which the animal could be selected out from among the others, which on the testimony of this gentleman showed no sign that "amounted to anything" of their being diseased, and that the only way of finding its presence was by a critical examination of the lung itself after the animal had been killed? Was ever such a case of acute contagious pleuro-pneumonia with this amount of lung implicated heard of before? I think not; and still this gentleman, who has had great experience with this disease, who knows that in Edinburgh the existence of "pleuro" is generally discovered by an examination made of the live animals in the byre, and not of the dead ones made in the abattoirs, and before he has had sufficient time to finish his examination to his own entire satisfaction, says that without a doubt these animals were affected with contagious pleuro-pneumonia! Now, I submit, are there not in this *evidences* of a hurried examination? Has it not obviously been taken for granted that the detection of contagious pleuro-pneumonia, *post mortem*, was a thing requiring a knowledge only of a most superficial sort? And I ask the authorities in this case if, in view of all the facts, it is not possible, nay, even probable, that a disease of not a sufficiently pronounced character to interfere with the well-doing of these animals may exist that shall give to the naked eye, upon examination of the lung *post mortem*, the exact appearances of contagious pleuro-pneumonia, but which is not that disease, but the result of some chronic process, the nature of which, in the absence of all history of the animal, may require a most careful and minute examination to detect its real differences?

The only gentleman engaged in the affair who seems at that time to have been of my present opinion and to have realized its importance is Professor Williams, of Edinburgh, who was called to Liverpool in precisely the same manner as was Professor Walley. This gentleman, who spent more time in the examination, who has had at least as large an experience as have any of the others, said, when he had finished the ex-

amination in Liverpool and was asked for his opinion, "I have as yet no opinion to give, and shall have none until I have been able to make a more thorough examination of the lung." For this purpose he took with him to Edinburgh portions of the lung, and he received from Mr. Wellsby, a veterinary surgeon in the employ of Messrs. Warren & Co., the steamship owners, for the next six months, portions of the diseased lungs which were condemned by the inspector at Liverpool, all of which received a most careful examination by himself and Dr. Hamilton, pathologist to the Royal Infirmary, and demonstrator of morbid anatomy in the University of Edinburgh, and after all this he declares that he has "not the slightest hesitation in saying that in no case has he found them to exhibit the characteristic lesions of contagious pleuro-pneumonia." Therefore it seems to me that there is, *at least*, fair reason to doubt whether the disease noticed among this cargo of the Ontario was really contagious pleuro-pneumonia. I have not gone into the discussion of this question in any captious spirit of criticism, neither do I mean for a moment to call into question the professional ability of any of those gentlemen, which I believe to be of the highest quality, and I most thoroughly believe that their decisions were given in accordance with their honest convictions; but if these convictions were arrived at too hastily, and before proper, and, in view of the gravity of the question, sufficiently exhaustive examinations of the facts were made, it is certainly my privilege to comment upon them, and show, if possible, that it was so. And if any statement or argument that I have advanced seems to be of sufficient consequence to really throw a doubt upon the decision of the authorities of Great Britain in this matter, I would most respectfully suggest that in fairness to the great interests of the United States, which are by this decision very severely prejudiced, that the judgment should at least be reconsidered.

My own opinion, arrived at after a most thorough and careful investigation and consideration of the facts, is that the lungs which were condemned by the Inspector of the Privy Council at Liverpool during my stay there in parts of July and August last, as being affected with contagious pleuro-pneumonia, were in reality not affected with that disease. And further, I do not believe that a single case of contagious pleuro-pneumonia has ever existed in the West or has been landed in England from our ports of Boston or Portland, unless, indeed, it may have been communicated to the animals after they were placed on board the ocean steamer, from previous contamination of the vessel, by transportation in it of diseased animals from Great Britain to America, an event which I must say that in the case of pleuro-pneumonia I think to be very unlikely.

Respectfully submitted.

CHARLES P. LYMAN, F. R. C. V. S.

Hon. WM. G. LE DUC,
Commissioner of Agriculture.